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Progress Report

on

Compatibility Study of the MAGSAT Data and Aeromagnetic Data in  
the Eastern Piedmont of U. S. - NAS5-26157

(E81-10108) COMPATIBILITY STUDY OF THE  
MAGSAT DATA AND AEROMAGNETIC DATA IN THE  
EASTERN PIEDMONT OF US Progress Report  
(North Carolina State Univ.) 12 p  
HC A02/MF A01

N81-22444

Unclas  
CSCL 08F G3/43 00108

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RECEIVED

December, 1980

JAN 9, 1981

SIS/902.6

M-008

TYPE II

## Summary of Report

This progress report contains the results of (1) analysis of MAGSAT data of November 5 and 6, 1979, the only fine altitude data maps available to us thus far, and (2) analysis of Project MAGNET data in order to prepare the U.S. aeromagnetic field map which will be used as a basis for our comparative study with the MAGSAT data.

### Analysis of MAGSAT Data of November 5-6, 1979

At the time of this report, the sole MAGSAT data made available to us by GSFC consists of the two-day period record of November 5 and 6, 1979 containing 28,648 data points. The orbital paths of the records are shown on Figure 1.

Based upon these data we produced world magnetic maps of (1) scalar total field (Figure 2) and (2) three vector component total fields (Figures 3, 4, and 5); subtracting the reference field of MAGSAT 6/80 provided by GSFC, (3) scalar anomalous field (Figure 6) and (4) three vector component anomalous fields (Figures 7, 8, and 9).

No attempt of data modification such as filtering or matching the cross-point data was made. After removing 718 bad points from the original data, we picked every fifth point for the contouring purpose. Reducing the data amount to one-fifth was quite reasonable since the data density along the satellite path is far greater than the spacing of the paths.

As evidenced from the maps (Figures 2, 3, 4, and 5), the main geomagnetic field of the Earth is surprisingly well mapped considering the short data period. However, the anomaly maps, obtained after removing the 13th order reference field, appear to suffer from the data sparseness. Yet the scalar anomaly maps (Figure 6) contain many features which agree well with the map derived from the POGO data, including the Bangui anomaly in Africa. The vector anomaly maps (Figures 7, 8, and 9) seemingly contain considerable errors as noted by the large low harmonic

field particularly along the equator. Langel (personal communication) pointed out that this is most likely due to errors in computing the reference field. If this is the case, we intend to reprocess the data upon receiving new reference field data.

The crustal anomaly study on the eastern U.S., our main objective, requires much more data density to be meaningful. As it stands now, it appears that we might have to wait until we receive the entire MAGSAT investigator tapes before we proceed to the geological interpretation of the MAGSAT data in this region.

#### Preparation of U.S. Magnetic Chart Based on MAGNET Data

The main objective of our original proposal pertains to the comparison between the MAGSAT data and the available aeromagnetic data in the eastern U.S. We have put a considerable effort to prepare a large scale U.S. aeromagnetic map which can be upward-continued to the satellite altitude. Most of the state or local aeromagnetic maps, due to various reasons, cannot be easily patched up to make a large scale map.

For this reason, we acquired the entire MAGNET U.S. aeromagnetic survey data from the National Geophysical and Solar-Terrestrial Data Center (NGSTD) of NOAA. The data were collected during 1976 and 1977 at altitudes (AGL) of 500-700 m in non-mountainous terrain and 900-1,000 m in mountainous terrain. The MAGNET file contains some 650,000 measurements at approximately a 100 m interval along the flight path. Spacing between the N-S flight paths is about 1.1 degree in longitude. Since the data density along the path is much higher than the spacing, we averaged over every 100 data points to reduce the total data amount to about 6,500. This gives approximately 0.1 degree sampling interval along the path. Figure 10 shows the total field contour map along with the flight paths.

A 12th order and degree geomagnetic reference field at 1980.0 with the secular variation up to 6th order and degree provided by D. R. Barraclough

(personal communication, 1979) was removed to produce a U. S. aeromagnetic anomaly map shown on Figure 11. By upward-continuing this field to a 300 km altitude, we obtain the resultant map shown on Figure 12. Comparing with the POGO data compiled by Mayhew (1979) as shown in Figure 13, we note a considerable difference in the anomaly structure. This is most likely due to insufficient removal of the reference field.

Assuring that the upward-continued field in Figure 13 should be a part of the reference field, we removed it again from the anomaly map (Figure 11) and upward-continued the difference by 100 Km (Figure 14) and 300 Km (Figure 15). The overall resemblance with the POGO data is somewhat improved particularly for such prominent features as the anomaly in Kentucky-Tennessee region. Presently, we are reprocessing the data using the reference field of GSFC (9/80-2). It is expected that the new reference field would better remove the low harmonic field thus improving the anomalous field structure. The result will be presented in the next progress report.

MAGSAT ORBITAL PATHS · NOV 5-6, 1979

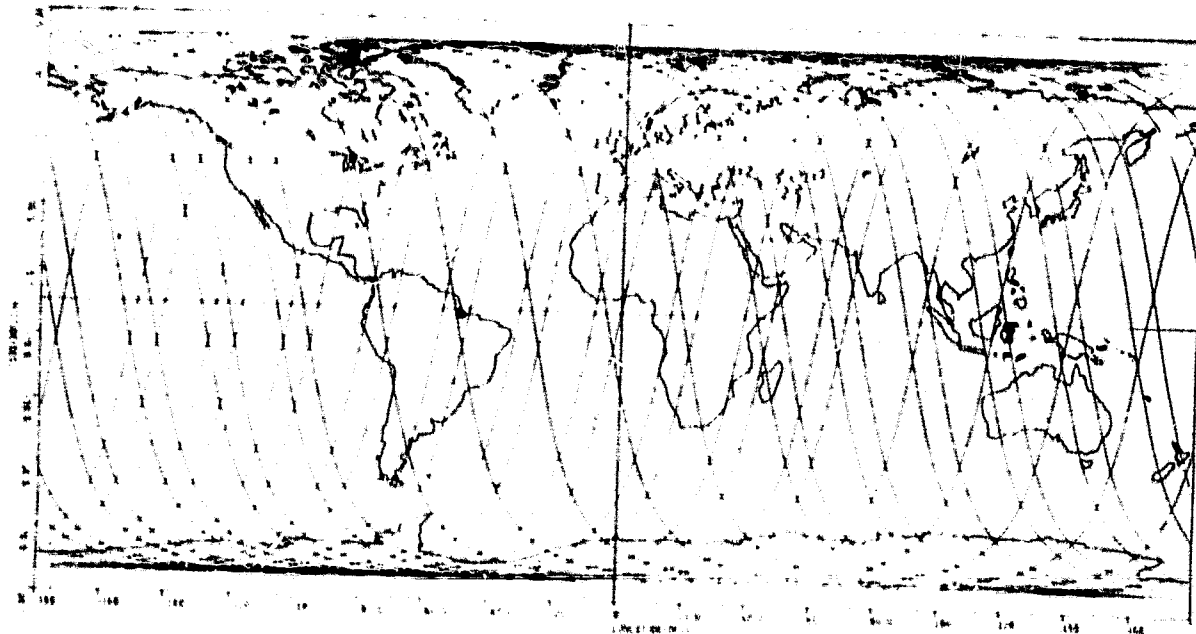


Figure 1

MAGSAT TOTAL FIELD

11/5-6/79

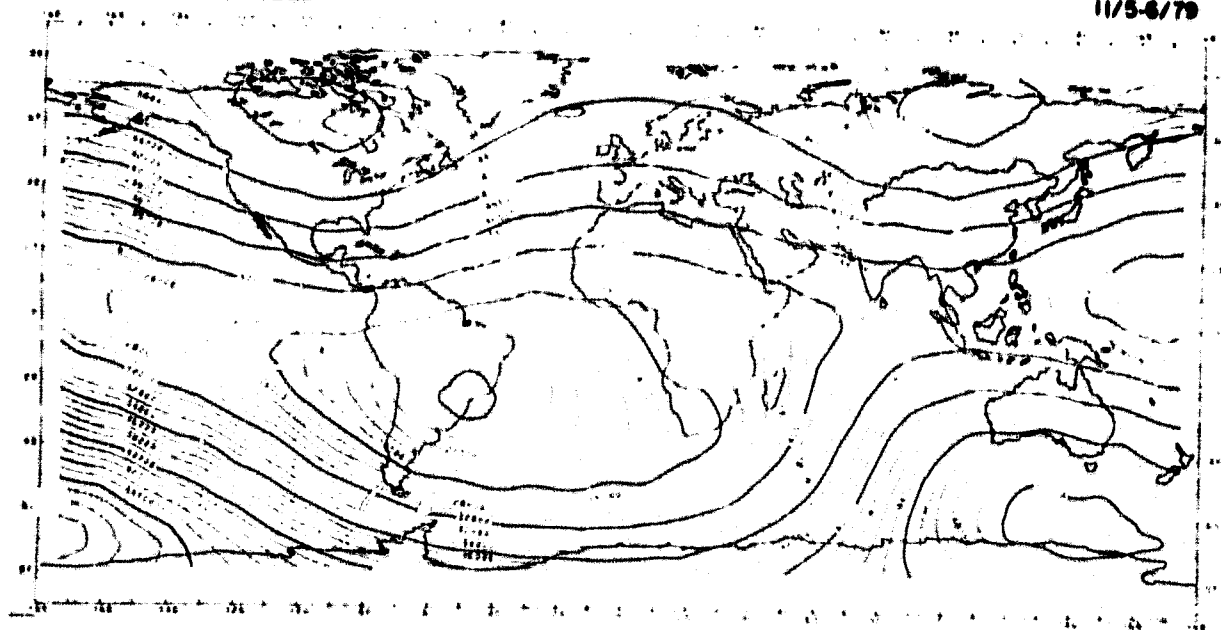


Figure 2

MAGSAT VERTICAL FIELD

11/5,6/79

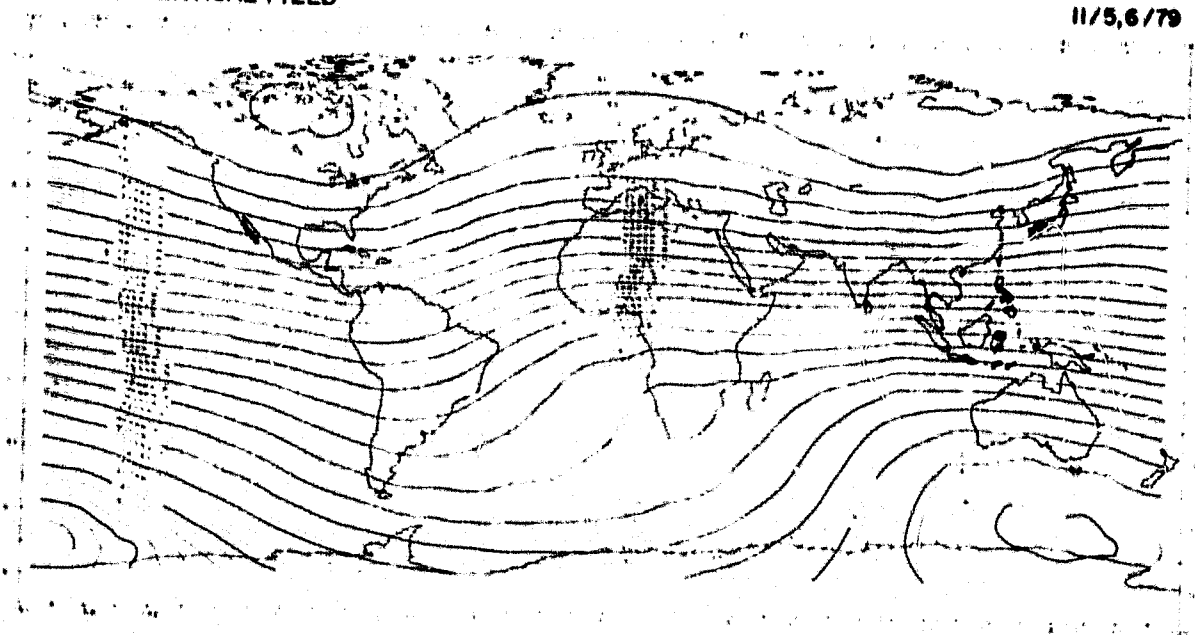


Figure 3

MAGSAT N-S FIELD

11/5-6/79

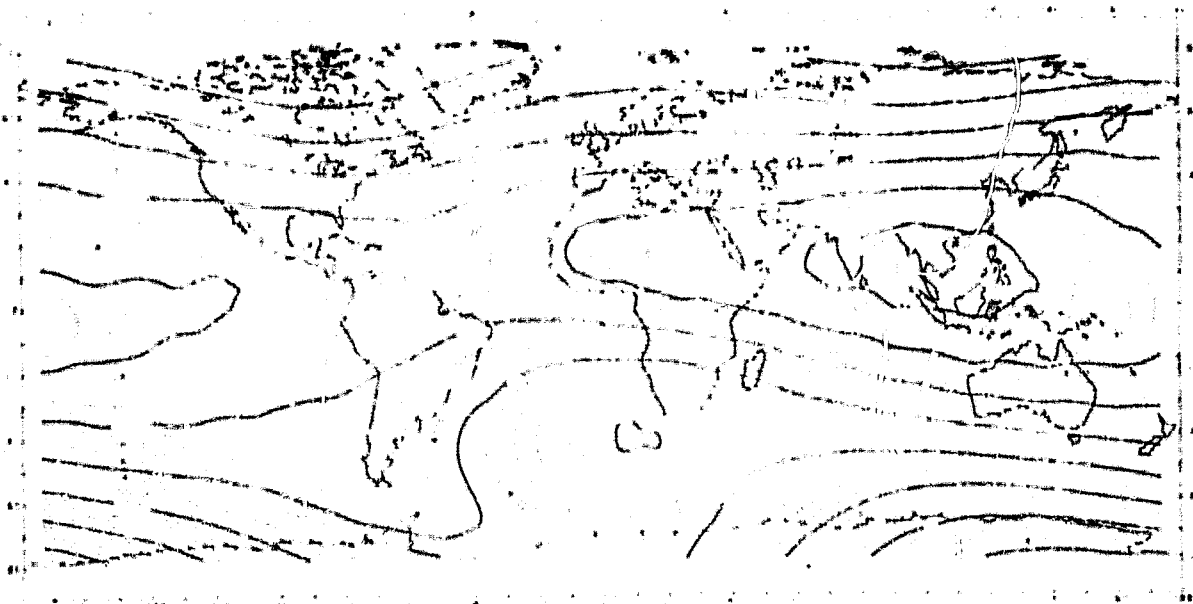


Figure 4

MAGSAT E-W FIELD

11/5,6/79



Figure 5



MAGSAT RESIDUAL TOTAL FIELD

11/5,6/79

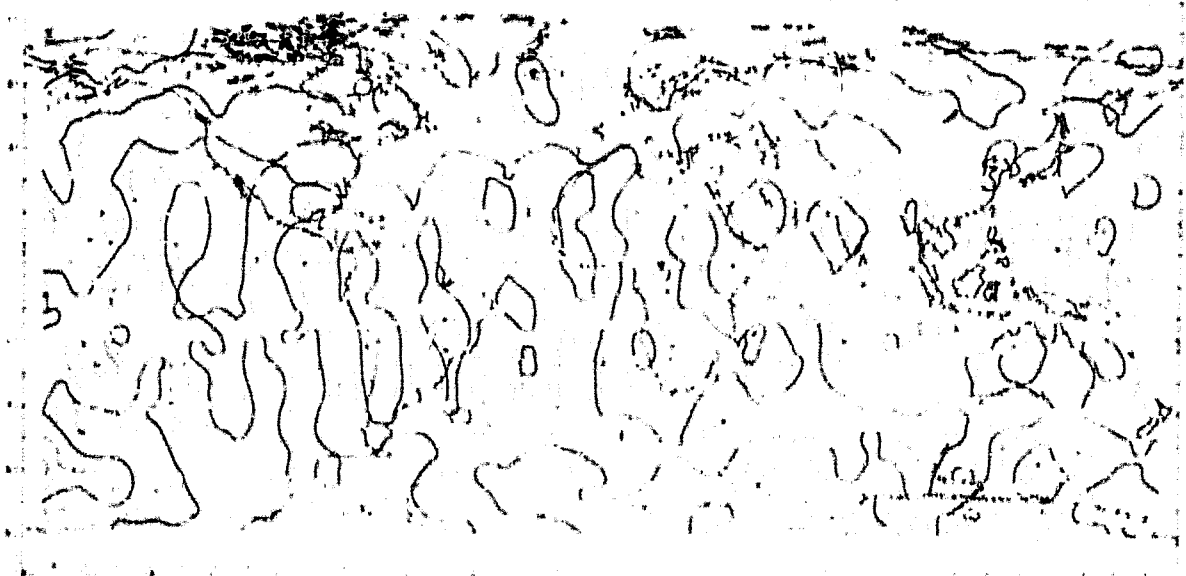


Figure 6

MAGSAT RESIDUAL VERTICAL FIELD

11/5,6/79



Figure 7

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OF FOUR

MAGSAT RESIDUAL N-S FIELD

11/5,6/79



Figure 8

MAGSAT RESIDUAL E-W FIELD

11/5,6/79

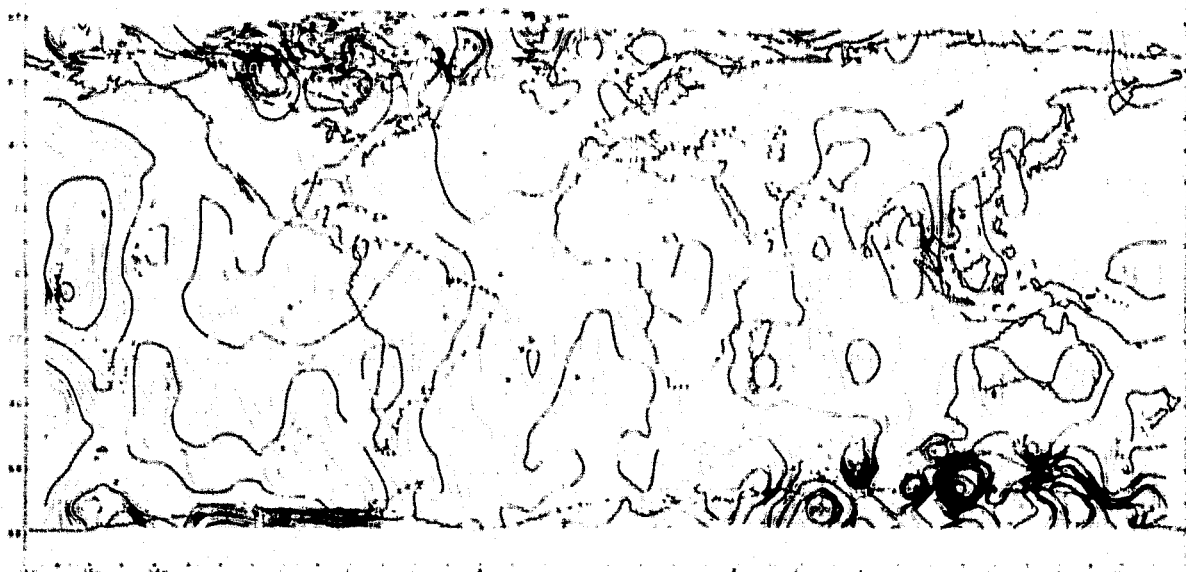


Figure 9

# MAGNET AEROMAG TOTAL FIELD & FLIGHT PATHS

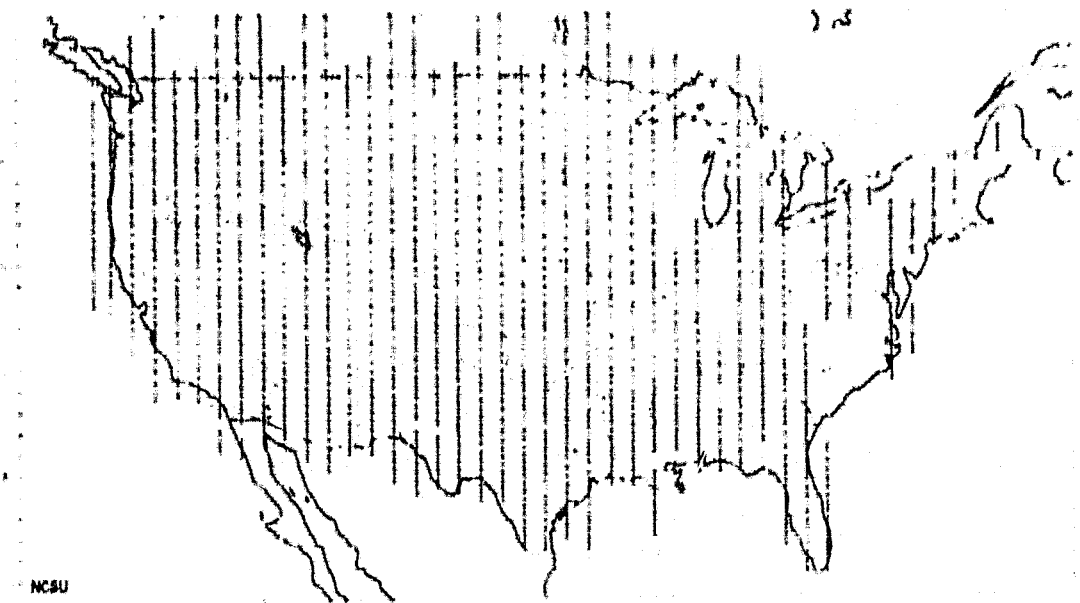


Figure 10

## MAGNET US AEROMAG MAP(12th order)

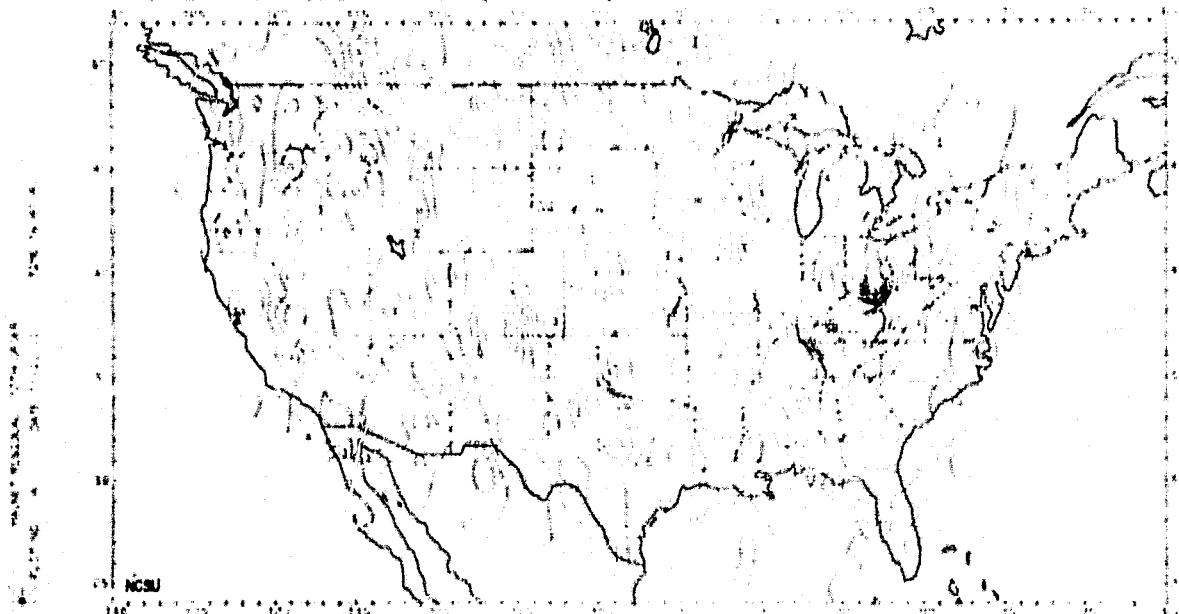


Figure 11

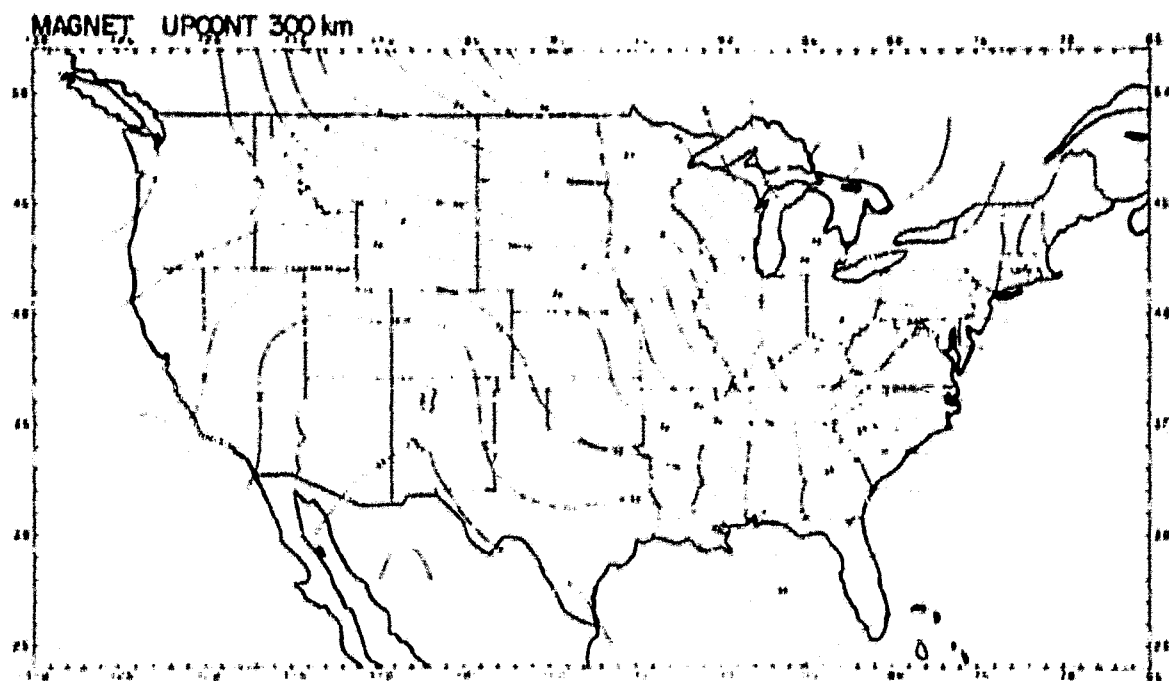


Figure 12

EQUIVALENT BULK MAGNETIZATION DERIVED FROM POGO SATELLITE DATA ASSUMING  
A CONSTANT THICKNESS MAGNETIC CRUST OF 40 KM. UNITS ARE EMU CC  $\times 10^4$

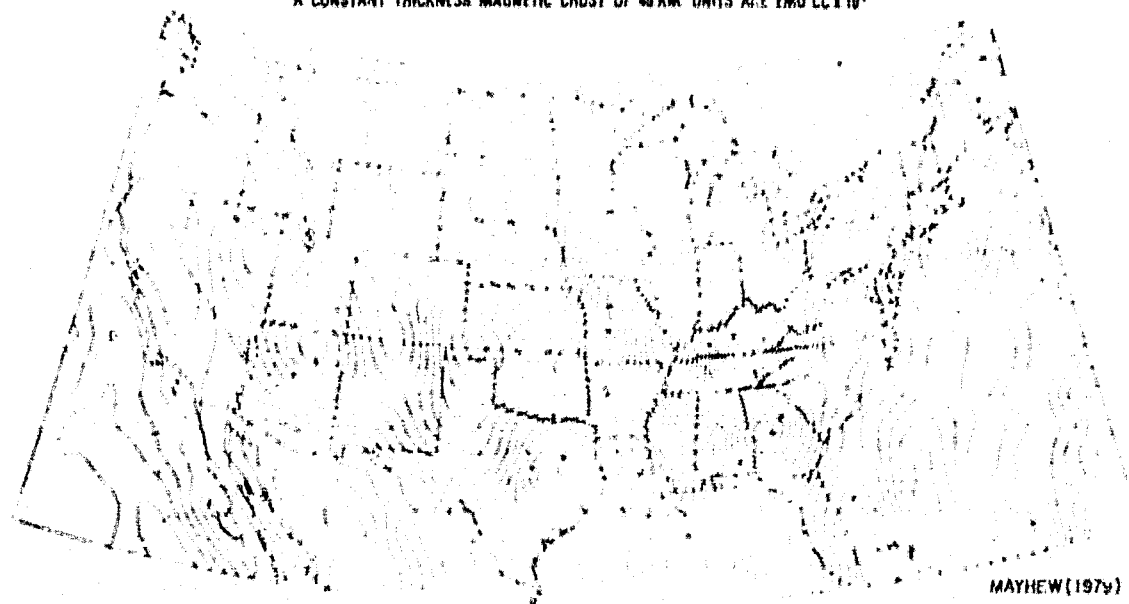


Figure 13

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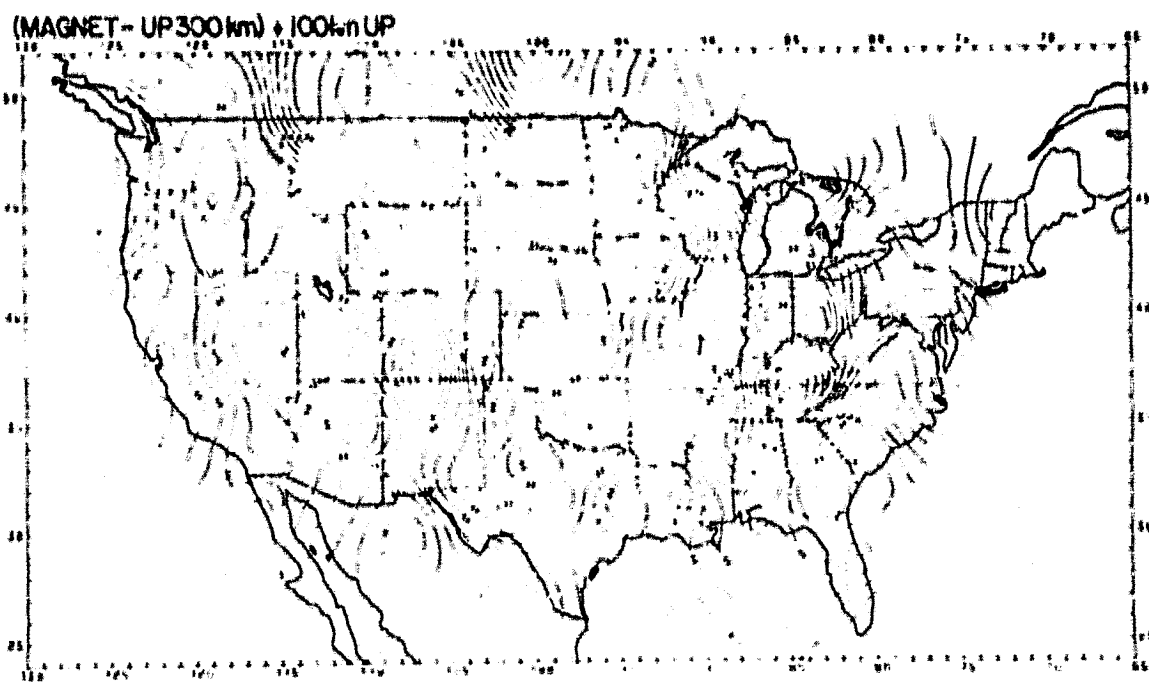


Figure 14

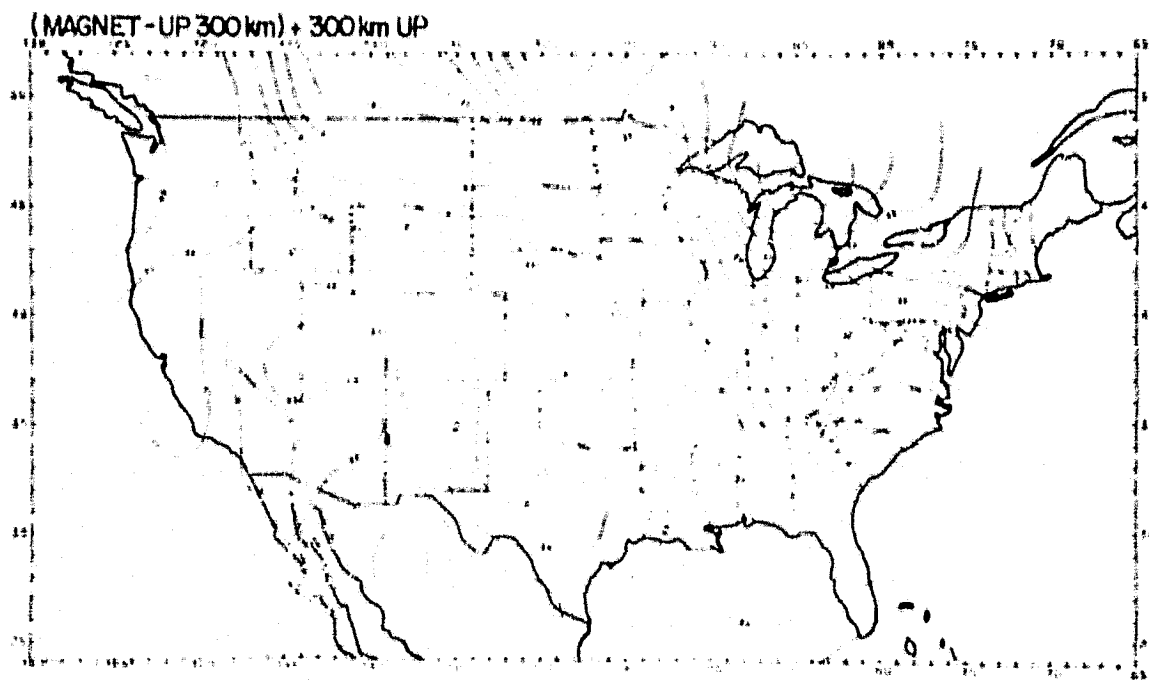


Figure 15